



From valence to emotions: Exploring the distribution of emotions in online product reviews



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ABSTRACT

Word-of-mouth (WOM) in the form of online customer reviews has received considerable attention by practitioners and academics. Prior literature has focused more on the understanding of the phenomenon using the frequency or overall rating/valence information of WOM, while questions on how firms can potentially use or design online WOM platforms and benefit from it based on the *content* of WOM are still open, and need more attention from researchers. In addition, an important antecedent for the generation of word-of-mouth is a strong emotional imbalance known as schema discrepancy, which is considered to trigger the consumer to post a customer review online. However, only a limited number of studies to date have actually examined the emotional content of reviews to validate this line of reasoning. To fill this gap, we analyzed the *emotional content* of a large number of online product reviews using Natural Language Processing (NLP) methods. We find that there is a difference in the emotional content of reviews across search and experience goods in the early stages of product launch. However, interestingly, these differences disappear over time as the addition of reviews reduces the information asymmetry gap. This suggests that traditional experience goods are evaluated more like search goods in online environments, because consumers can easily evaluate attributes of products prior to purchase based on the reviews accumulated. In addition, we find that more extreme reviews have a greater proportion of emotional content than less extreme reviews, revealing a bimodal distribution of emotional content, thereby empirically validating a key assumption that underpins much of the extant literature on online WOM. Furthermore, reviews have a greater proportion of positive emotional content within positive extreme ratings as compared to negative emotional content within negative extreme ratings which is a major factor in online WOM generation, and helps explain the commonly observed J-shaped distribution of reviews. Our findings suggest important managerial implications regarding product development, advertisement, and platform design using WOM content.

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1. Introduction

Word-of-mouth (WOM) has been described as one of the most important means of informal communication among consumers [16,19,29,59]. Among them, online customer reviews for products or services can be formally defined as peer-originated product evaluations placed on company or third-party web sites [41]. In the case of retail websites (e.g., Amazon.com, Google Play Store, etc.), customer reviews include both the textual product reviews written by customers along with product evaluations in the form of numerical star ratings (e.g., between 1 and 5 stars). Such forms of online product reviews have become one of the

key drivers influencing product sales and corresponding marketing strategies because they provide useful information to consumers as well as to product manufacturers and retailers [11,16].

Therefore, previous studies of WOM have examined the importance of online WOM in general, and user-generated product reviews in particular. Specifically, they focused on the volume and valence of online WOM and their effect on product sales [11,15,18,25,40,65]. The findings suggested that while the volume of product reviews have shown a direct correlation with product sales [11,15,25,40,65] through a cascading effect [14], the effect of the valence of the reviews on sales has been less conclusive [11,65]. In other words, these previous studies' scope of inquiry has been limited to WOM frequency or related factors.

However, a key problem with analyzing the volume and valence of WOM to understand consumer's WOM behavior is the under-reporting bias as suggested by Hu et al. [26], whereby only those consumers who are extremely satisfied or extremely dissatisfied write reviews, while

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those consumers who felt that the product was “just okay” may not be motivated to post a review. This usually leads to a bimodal pattern of review distribution, where the extreme reviews (extreme positive such as 5-star rating and extreme negative such as 1-star rating) tend to dominate in numbers. It has been further suggested that the bimodal distribution is a *J*-shaped distribution [1,11,16,26,36,51] because of the self-selection bias, where consumers who are favorably disposed to a product purchase and then evaluate it [26]. In this paper we attempt to study this skewed bimodal distribution using an emotion-framework known as schema discrepancy [19], where eWOM is viewed as an online form of catharsis (emotional release) [29,50].

In the emotion-framework, it has been shown that emotions play an important role in consumer response, thus firmly establishing the significance of emotion to consumer behavior [46,49,64]. Especially, previous studies consistently emphasized the important role of emotions in social sharing, particularly with respect to consumer WOM behavior. For example, both Berger and Milkman [5] and Stieglitz and Dang-Xuan [57] recently showed how emotional content significantly affects the sharing of online content using psychological field experiments and emotional twitter messages. As such, it is important to examine the emotional content in product reviews to better understand the idiosyncrasies of online WOM communications. However, we are unaware of any previous research that looks more specifically at the emotional makeup of review content, although emotions are the driving force behind online review articulation [1,63]. In this study, we examine the emotional content within reviews based on the schema-discrepancy theory for eWOM.

In addition to acting as a form of catharsis, online WOM communications are very helpful to prospective consumers who use online reviews to help make a decision. Indeed, one of the goals of writing a review (and a means of obtaining catharsis) is to influence decision makers who are seeking information about the product. Consumer read reviews to reduce their purchase risk, and to get advice on whether to purchase the product or not. In other words, reviews can also be a source of product-usage information [29,30]. Therefore, reviews are particularly important for experience goods, which are products dominated by attributes which can only be evaluated after consumption, as opposed to search goods, whose dominant attributes can be evaluated prior to purchase [13,37,47]. Since consumers cannot evaluate experience goods properly prior to purchase, they tend to rely on the past experience of others, which are expressed as online reviews. We expect that as reviews pile up, and consumers have access to more and more past consumption experiences of others, experience goods may be evaluated more like search goods, in that their dominant attributes can now be evaluated prior to purchase and consumption. In a similar vein, it is expected that the schema-discrepancy (expected versus actual) experienced by these later consumers will be less, leading to less emotional reviews.

In this paper we develop an integrated approach toward eWOM, by connecting the related phenomena of customer satisfaction, schema discrepancy, information search, and product type to explain the distribution of reviews. This is important as the extant literature on eWOM is not conclusive and even sometimes contradictory, and this research will help toward understanding the underlying processes at work. Since consumers read reviews to help fill in their information gaps prior to making a decision, it is important that we gain an understanding of the emotional makeup of reviews across product types (search vs. experience) and across time (accumulation of reviews).

To this end, we analyze emotional content and its characteristics in WOM communications by analyzing the emotional content of a large number of online product reviews on Amazon.com using Natural Language Processing (NLP) techniques. By using NLP, we computationally analyze and understand the natural human linguistic aspects of WOM focusing on emotions. More specifically, using NLP, we are able to examine the proportion of emotional content in online product reviews across different star ratings and the distribution of emotional content

in positive and negative product reviews as well as over time, which enables us to characterize unexplored characteristics of online WOM content. In addition, we also overcome the limitation of previous studies that focused on only a similar set of products, by examining the differences among customer reviews depending on product types (search vs. experience goods), which were considered to be open questions until now [15,22].

We found that there is a difference in the emotional content of reviews between search and experience goods in the early stages of product launch. However, these differences disappear over time as the addition of reviews reduces the information asymmetry gap. This provides support to the notion that traditional experience goods are evaluated more like search goods in online environments [28], because consumers can easily evaluate products prior to purchase based on the reviews accumulated. In addition, we found that more extreme reviews have a greater proportion of emotional content than less extreme reviews, revealing a bimodal distribution of emotional content, thereby empirically validating a key assumption that underpins much of the extant literature on online WOM. Furthermore, reviews have a greater proportion of positive emotional content within positive extreme ratings as compared to negative emotional content within negative extreme ratings which helps explain the skewed bimodal or *J*-shaped distribution which is commonly found in the frequency distribution of online reviews [10,11,26,36,51].

Our findings not only enable us to understand the fundamental nature of customer reviews, but also suggest several important implications for managers of electronic commerce, especially regarding product development, renovation, and advertisement. For example, product features which occur in 5-star reviews can be emphasized in advertisements because those features are the most emotionally stimulating aspects for consumers. Even the negative emotions can also be used to improve their offerings on the production side and to troubleshoot their inventory and service from a customer service perspective. The longer reviews with less emotional words in mid ratings regions may also reveal valuable information about the strength and weakness of the products that consumers have experienced. Lastly, our approach using NLP methods in analyzing WOM contents introduces a way to utilize large numbers of customer reviews that are usually a rich but unstructured set of consumer data with noise and unusable information in order to extract important marketing insights from them.

To this end, in Section 2, we discuss the theoretical background regarding the role of emotions in consumers' WOM behavior and related WOM distributions. Section 3 presents the pretest we implemented in order to categorize our data into different product types, and the methods we use to test our hypotheses including NLP techniques. Section 4 provides our results regarding the three hypotheses we suggest in Section 2. Finally, in Section 5 we discuss and summarize the main points of this paper and discuss important managerial implications of our findings.

2. Background and hypothesis

Previous research has investigated the relationship between consumption-related emotions and consumer behavior [46,49,63,64]. They showed that emotions play an important role in consumer response, thus firmly establishing the significance of emotion to consumer behavior [49]. In other words, they showed that emotions yield important psychological consequences and generate long-lasting mnemonic recurrences as well as acting as motivation for social sharing [54]; any highly satisfactory or highly dissatisfactory experience elicits strong emotional responses and these charged emotions create an emotional imbalance [1]. This emotional imbalance is caused by schema discrepancy, whereby expectations about a product or service are not realized, leading to surprise [19]. Then, a second emotion follows, such as joy (positive) or anger (negative), which causes one to assume that either positive or negative surprise was elicited [1,29]. This emotional

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